

# Index

- ABS, *see* acrylonitrile-butadiene-styrene  
acrylonitrile-butadiene-styrene (ABS) 10  
adhesives 12, 16, 20, 22–23, 55, 309  
admicelles 116–119, 130  
adsorption  
    counterion 107–108  
    physical 115  
adsorption mechanisms 115, 122, 129, 161–162  
AFM, *see* atomic force microscopy  
aliphatic polyesters 28, 303  
alkylammonium ions 88, 114, 124–125, 145, 151, 153, 155, 172, 192, 196, 200  
    pseudotrimolecular layers of 154, 196  
alkylammonium salt 132, 196–197  
alkylammonium salts, quaternary 158, 200  
aluminum 89–90, 94, 111–112, 195, 323  
amino acids 25–26, 31, 137, 250  
ammonium cations 134, 199, 254–255  
ammonium groups 126, 153, 155  
ammonium salt 134, 201, 204, 212, 214  
    polymeric quaternary 133, 198, 277  
anilinium cations 136–137, 150–151  
anionic polymerization 51–53, 59  
aromatic diamines 32–33  
aromatic dianhydrides 32, 36  
aromatic polyamides 34  
aromatic polyimides 32, 34  
atomic force microscopy (AFM) 106, 256, 261  
Bakelite 1, 3, 5, 16–17  
ball clays 94  
barrier properties 271–272, 278, 294, 307, 318  
basal spacings 101, 113, 123, 126, 133–137, 144, 146, 148–152, 154–156, 158–160, 196, 199, 201–203, 242, 251  
bentonites 96, 112, 134, 198–199, 203, 205, 215–216, 223, 297  
benzene 10, 194, 222–223, 247  
berthierine 91–92  
bioactive glass 311–312  
biodegradation 301, 305  
biomaterials 300, 307, 313–314  
    polymer nanocomposite 301  
biomedical polymer–silicate nanocomposites 300  
biomolecules 137  
Bragg's law 101–102, 256, 258  
butadiene 45–46, 54  
carbanions 51–52  
carbon atoms 10, 14–15, 25–26, 155–156, 170, 254  
carbon dioxide 52, 265–266, 294–295, 297  
carbon monoxide 265–266  
carbon nanotubes 239, 317  
cation exchange 115, 135, 144, 191, 195–197, 200–209, 213, 215–216, 248, 254

- cation exchange capacity (CEC)  
 111, 113, 125, 127, 129,  
 131–133, 148–151, 159,  
 171, 196, 201–202, 225,  
 250, 254–255, 297
- cationic surfactants 117, 125,  
 132, 134, 144, 148, 158,  
 164, 196, 200, 222, 225,  
 276  
 long-chain 131, 152
- cations, alkylphosphonium 122,  
 169, 196
- CC, *see* cone calorimeter
- CEC, *see* cation exchange capacity
- chain reaction polymerization 47
- chemical oxygen demand (COD)  
 316
- chlorites 100, 106
- chlorobenzene 222–223
- clay dispersion 215, 259, 263,  
 278, 319
- clay layer separation 243
- clay minerals  
 dried 158, 199  
 mixed-layer 100  
 modification of 137, 158, 200  
 modified 156  
 properties of 98, 144  
 structure 89  
 surface modification of 87,  
 115, 203
- clay nanocomposites 202, 259,  
 267, 269–271, 297
- clays  
 adsorptive 144–145  
 flint 94  
 inorganic 241  
 layered 241, 314  
 organic 147, 323  
 organophilic 144–145, 223  
 pillared 102, 111
- coagulation 23, 315–316
- COD, *see* chemical oxygen demand
- composites, polymer-clay 277
- condensation polymerization 54
- cone calorimeter (CC) 256,  
 264–265
- controlled release 302–303,  
 308–309
- coordination polymerization  
 50–51, 53–54
- dexamethasone 307–308
- dicarboxylic acid 14, 28, 31
- differential scanning calorimetry  
 (DSC) 71, 103, 146, 169,  
 247, 256, 261, 276–278
- differential thermal analysis (DTA)  
 71, 103, 146, 193
- DMA, *see* dynamic mechanical  
 analysis
- DMTA, *see* dynamic mechanical  
 thermal analysis
- DSC, *see* differential scanning  
 calorimetry
- DTA, *see* differential thermal  
 analysis
- dynamic mechanical analysis  
 (DMA) 73–74, 269, 274
- dynamic mechanical thermal  
 analysis (DMTA) 73, 256
- elastomers 4, 7, 55, 66, 277
- electrostatic interactions 119,  
 137, 151
- epichlorohydrin 16, 54, 56
- epoxy resins 15–16, 56, 138, 271,  
 273, 297
- fireclay 94
- flame retardancy 71, 240,  
 270–271, 294
- flame retardants 270–271
- flocculation 315–316
- formaldehyde 3, 16–18, 36–38
- gas permeability 275–276, 299
- glass transition temperature 9,  
 60, 66–68, 71, 269

- heat-release-rate (HRR) 264–266, 299  
 hemi-micelles 117–119, 164  
 hexamethylenediamine 14–15, 31–32  
*HIL, see* hole injection layer  
 hole injection layer (HIL) 317  
*HRR, see* heat-release-rate  
 humic substances 224  
 hydrated polymeric networks 313–314  
 hydrocarbon chains 118–119, 126, 130–131, 147, 159  
 hydrophobic bonding 122, 129–131, 162–163  
 hydrophobic groups 115, 124, 130  
 hydrophobic interactions 117–119, 158, 164, 225  
 hydrophobic surface 107, 111, 116–117  
 illite 97–98, 105–106, 225  
 interlayer cations 100, 103, 114, 123, 126, 192, 195, 199, 223  
 interlayer packing density 146, 155  
 interlayer spacing 101, 122–123, 151, 169, 196, 251, 258  
 ion adsorption 107–108  
 ion exchange 87, 114, 122–125, 127, 129, 131–132, 135, 144–145, 150, 161, 164, 192, 195–196, 205–206  
 ion exchange capacity 112, 131, 134  
 ion pairing 122, 125, 129, 161  
 ion-dipole interactions 143, 148, 195, 199–200  
 ionic polymerizations 50–51  
 kaolin 93, 110–111  
 kaolinite 87, 92–94, 98, 105, 193–194  
 L-lactic acid 302–303, 311  
 lauryl acrylate 134, 212, 214  
*LEL, see* light-emitting layer  
*LHL, see* light-harvesting layer  
 light-emitting layer (LEL) 317  
 light-harvesting layer (LHL) 317  
 living polymerization 53  
 macromolecules 1–2, 5, 22–23, 25, 27, 31, 59, 66, 68, 114  
 magnesium 89–90, 112, 195  
 melamine 18, 37–38  
 melamine formaldehyde (MF) 18, 37  
 melt intercalation 166, 244, 252, 263, 275–276  
 methanol 9, 30, 52, 247, 299  
*MF, see* melamine formaldehyde  
 micelles 50, 116  
 microspheres 49–50, 302  
*MMT, see* montmorillonite  
 calcium 96, 111–112  
 modified 134–136, 141, 159, 167, 248, 250  
 MMT-based organoclays 130, 170  
 MMT modification 144, 165  
 montmorillonite (MMT) 96–98, 129, 135–137, 149–150, 158–159, 169–170, 193–194, 198–200, 202–203, 213–215, 247–252, 274, 276, 305–306, 309  
 nacrite 92–93  
 nanocomposite composition 262, 267  
 nanocomposite films 278, 323  
 polymer–MMT 324  
 nanocomposite formation,  
 polypropylene–MMT 169  
 nanocomposite hydrogels 313  
 nanocomposite polyethylene 262  
 nanocomposite scaffolds 305, 311

- nanocomposites
  - epoxy 136, 251
  - exfoliated 242, 255
  - hybrid 246
  - intercalated 242, 258
  - nitrile rubber–organoclay 299
  - organoclay–polyethylene 135
  - polyamide-6/MMT 277
  - polyamide–clay 269
  - polyethylene terephthalate–MMT 135
  - polymer-based 317
  - polymer–organoclay 200
  - Polyurethane 279
  - thermoplastic 250, 254
  - natural rubber 2, 23–24
- NMR, *see* nuclear magnetic resonance
- nuclear magnetic resonance (NMR) 69, 102–103, 138, 147, 169, 256, 263
- octadecyl-ammonium chloride 204, 206, 209
- octahedral sheets 90, 93–94, 96, 99, 110–111, 138, 195
- odinite 92–93
- OMLS, *see* organically modified layered silicate
- organically modified layered silicate (OMLS) 87, 131, 252, 304
- organobentonites 133–134, 198–199, 277–278
- organoclay dispersion 253, 259
- organoclays, surfactant–intercalated 202
- palygorskite 87, 92, 99, 112, 193
- PF, *see* phenol formaldehyde
- phenol formaldehyde (PF) 16, 37–38
- phosgene 28, 30–31
- phylosilicates 94, 97, 110, 112, 132
- PLS, *see* polymer-layered silicate
- PLS nanocomposites 240, 242, 246, 250, 256, 263
- PMMA, *see* poly(methyl methacrylate)
- PMMA-silica nanocomposites 321
- poly-3-hydroxybutyrate 26
- poly(methyl methacrylate) (PMMA) 9, 44, 47, 245, 310, 321
- Polyamides 4, 14, 28, 30–31, 34, 56, 127, 158, 200, 243, 277–278, 318, 324
- Polybenzimidazoles 34–36
- Polybenzoxazoles 34–35
- polycaprolactam 56, 58
- polycaprolactone 29, 245, 247, 303
- polycarbonates 30
- Polycondensation 29
- Polyesters 4–5, 10, 16, 18, 27–29, 303, 321
- Polyethers 34, 39–40
- Polyethylene 3, 5, 7–8, 10, 19, 47, 68, 158, 200, 275, 302, 322
- Polyimides 28, 32, 34, 248, 279, 318
- Polyisoprene 24
- Polymer-based nanocomposite systems 245, 249
- Polymer characterization 69–73
- Polymer-clay nanocomposites, exfoliated 244
- Polymer coatings 273
- Polymer composites 74, 293
- Polymer crystallinity 72, 74, 305
- Polymer intercalation 248, 254
- Polymer-layered silicate (PLS) 97, 169, 240, 293
- Polymer nanocomposites, silicate-based 307
- Polymer–clay nanocomposites, exfoliated 263

- polymeric quaternary ammonium salts (PQAS) 133, 198, 277  
 polymerization  
     cationic 51–52  
     chain-growth 27, 40  
     diene 45  
     emulsion 49–50  
     free-radical 41, 44, 51–52, 165, 304  
     intercalative 244, 252, 322  
     interparticle 114, 192  
     low-temperature 58–59  
 polymerization of ethylene 7–8  
 polymerization of monomers 133, 169, 196  
 polymerization of propylene oxide 55–56  
 polymers  
     aromatic ladder 35–36  
     biodegradable 240, 302  
     cationic 52, 316  
     ladder 36  
     linear 6, 22, 277  
     living 53  
     natural 1–2, 5, 22, 26, 301–302, 309, 311  
     polyurethane 19, 21  
     step-growth 27–29  
     synthetic 3, 5, 12, 14, 16, 239  
     thermoset 7, 36, 61  
     virgin 240, 269–270, 294, 299, 305  
 polyols 19–20, 28  
 polypropylene 8, 63, 68, 158, 200, 263, 277, 319, 322–323  
 polystyrene 1, 3, 5, 9–10, 44, 47–49, 270, 273, 299  
 polysulfides 34, 40  
 polysulfone 28, 34, 40, 273  
 polytetrafluoroethylene 19  
 polyurethane 5, 19–21, 28, 318  
 polyvinyl alcohol 13  
 PQAS, *see* polymeric quaternary ammonium salts  
 propylene oxide 54–55  
 QACs, *see* quaternary ammonium cations  
 quaternary ammonium cations (QACs) 127, 144, 164, 201  
 ring-opening polymerization (ROP) 28, 54–55, 167, 250, 303  
 ROP, *see* ring-opening polymerization  
 rubber nanocomposites 274  
 scanning electron microscopy (SEM) 104–105, 145, 148, 256, 258, 260  
 SEM, *see* scanning electron microscopy  
 sepiolite 92, 99, 112, 135, 193, 206  
 silica 111, 116, 118, 312, 321–322, 324  
 silica nanoparticles 304, 313  
 silicones 21–22  
 smectite clays 112, 143  
 smectites 95–98, 103, 111–113, 127, 137, 164, 166, 192–193, 201, 223  
 smectitic clay minerals 114, 195  
 sodium montmorillonite 96, 111, 134–135, 158–159, 204–206, 209, 254  
 sodium montmorillonite cloisite 206–207, 214–215  
 sodium montmorillonite kunipia 204, 209  
 sol–gel techniques 245–246, 312  
 step-growth polymerization 27–29

- substitution  
isomorphic 95–96, 107, 110  
isomorphous 94, 96, 98, 100,  
133  
sulfur 4, 24  
surfactants  
intercalated 146–147, 197  
nonionic 116–117, 134, 196  
organic 125, 131, 145, 159,  
195
- TEM, *see* transmission electron microscopy  
terephthalic acid 29, 34–35  
TGA, *see* thermal gravimetric analysis  
thermal gravimetric analysis (TGA)  
70–71, 103, 141, 145–147,  
247, 256, 261, 269–270,  
278  
thermoplastic polyurethanes 20  
transmission electron microscopy  
(TEM) 105, 145, 148, 172,  
246–247, 256, 258–260,  
263, 277, 297
- trichloroethylene 222, 224  
urea formaldehyde 3, 18, 37,  
259–260
- vermiculites 92, 99, 112, 123,  
132, 153, 158, 195, 199,  
299  
vinylbenzyl chloride 134, 212,  
214  
vulcanization 2, 4, 24
- wastewater pretreatment  
314–315  
wastewaters 224, 315–316
- X-ray diffraction (XRD) 71–72,  
101, 103, 145–146, 148,  
150, 199, 202, 247–248,  
256, 258, 263, 276, 278,  
297
- XRD, *see* X-ray diffraction  
zeta potential 160–162